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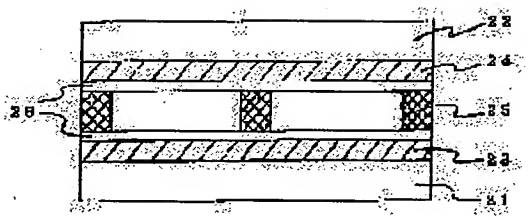
(54) TOUCH PANEL AND ITS MANUFACTURE

(57)Abstract:

PURPOSE: To improve the transparency, make the touch panel attractive, and secure manufacturing stability by forming a macromolecular layer containing conductive particulates on at least one transparent electrode surface.

CONSTITUTION: On at least one surface of a transparent electrode 24 formed on a transparent substrate 21, a polymerizable monomer or oligomer solution in which conductive particulates are preferably dispersed is applied and set by one of heating, ultraviolet-ray irradiation, electron-beam irradiation, and ozone exposure to form the macromolecular layer 26 containing the conductive particulates. At this time, the macromolecular layer 26 is formed preferably by incorporating transparent oxide consisting principally of tin oxide or ITO of ≤0.1 μm primary particle size as the conductive particulates in thermoset polysiloxane or photoset acrylic resin. Further, the macromolecular layer 26 containing the conductive particulates is formed preferably to 0.05-0.35 μm in mean film thickness. Consequently the transparency of the touch panel is improved.



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CLAIMS

[Claim(s)]

[Claim 1] A touch panel characterized by forming a macromolecule layer on the surface of a transparent electrode which contained a conductive particle in the whole surface at least in a touch panel which consists of transparence substrates which have a transparent electrode of one or more sheets.

[Claim 2] A touch panel according to claim 1 with which said macromolecule is characterized by being a thermosetting polysiloxane or photoresist acrylic resin.

[Claim 3] A touch panel according to claim 1 characterized by said conductive particle being the transparency oxide which uses tin oxide with a primary particle size of 0.1 micrometers or less or ITO as a principal component.

[Claim 4] A touch panel according to claim 1 with which a macromolecule layer containing said conductive particle is characterized by being 0.05-micrometer or more average thickness 0.35 micrometers or less.

[Claim 5] A manufacturing method of a touch panel characterized by forming a macromolecule layer which applied a polymerization nature monomer on the surface of a transparent electrode which a conductive particle distributed on the whole surface at least, or an oligomer solution, was further stiffened by method of heating, UV irradiation, electron beam irradiation, and one of ozone exposure, and contained a conductive particle in a touch panel which consists of transparence substrates which have a transparent electrode of one or more sheets.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the touch panel excellent in highly transparent and good-looking manufacture stability.
[0002]
[Description of the Prior Art] Although the touch panel used for an input unit has a difference in detection methods, such as a resistance detection method, a capacitive sensing method, and an electromagnetic induction type, its structure which consists of transparence substrates which have the transparent electrode of one or more sheets is common. As a transparence substrate, the glass plate or PET (polyethylene terephthalate) is usually used, and ITO and the tin oxide are used as a transparent electrode. A transparent electrode also has the case of whole surface homogeneity, and pattern NINGU may be carried out and it may be used. For the feel-of-writing improvement and ****** reason, the pen input screen stuck plastic film, and came to take the structure which established the detailed concavo-convex side in the surface. Only as an input unit of a simple substance, a touch panel is combined with CRT or LCD and is used also as equipment which can carry out information actuation on the display screen.
[0003]
[Problem(s) to be Solved by the Invention] However, since the touch panel consisted of transparence substrates which have the transparent electrode of one or more sheets, although it did not almost have attenuation of the quantity of light within a transparence substrate, it had the technical problem that 10% or more of quantity of light will be lost by the surface reflection especially by a transparent electrode and an air interface. Moreover, it was a big problem, when it was hard to see a panel by surface reflection, it used together especially with a display device and it used. When for the ****** reason the anti glare film was stuck or the structure which established the detailed concavo-convex field in the surface was taken, 10 to 20% of quantity of light of the total amount of transparency of light will be lost further, and the technical problem that white-faded by surface scattered reflection and display image quality deteriorated occurred.
[0004] As decrease reflective coating, the method of vapor-depositing low refractive-index materials, such as magnesium fluoride, and the method of carrying out the multilayer vacuum evaporationo of the material with which refractive indexes differ are learned, and it is put in practical use with the spectacle lens etc. Moreover, the method of forming a fluorine-containing macromolecule with a low refractive index by spreading is also shown. However, the conventional decrease reflective coating material had the fatal defect in which location detection could not be carried out, when insulation was high and was especially formed on the electrode by the most general resistance detection method. Moreover, the problem was shown also in adhesion or surface hardness.
[0005] Then, this invention solves such a technical problem and the place made into the purpose is located in the place which offers the touch panel excellent in highly transparent and good-looking manufacture stability.
[0006]
[Means for Solving the Problem] The above-mentioned purpose is attained in a touch panel which consists of transparence substrates which have a transparent electrode of one or more sheets by a macromolecule

layer on the surface of a transparent electrode which contained a conductive particle in the whole surface at least being formed. Moreover, in said touch panel, apply a polymerization nature monomer on the surface of a transparent electrode which a conductive particle distributed on the whole surface at least, or an oligomer solution, and it is made to harden further by method of heating, UV irradiation, electron beam irradiation, and one of ozone exposure, and can manufacture by forming a macromolecule layer containing a conductive particle.

[0007]

[Function] An interface with a refractive-index difference larger [the reflectivity of light] becomes large. The tin oxide and ITO which are usually used as a transparent electrode have a refractive index as high as 1.6 to 1.7, and its reflection by the interface of a transparent electrode and air is the largest. In order to use as decrease reflective coating, it is ideal that the refractive index of a coating material serves as a square root of the refractive index of a base material. Although 1.30 or less refractive index is an ideal for a count top, since the refractive index of a transparent electrode is high, if it is 1.55 or less refractive index of a coating material, a certain amount of effect will be acquired.

[0008] The thickness used in order to acquire the acid-resisting effect ordinarily is called for by odd times of /(wavelength of light)4/ (membranous refractive index), is 0.05-micrometer or more average thickness 0.35 micrometers or less practical, and 0.07 micrometers or more since it is 0.12 micrometers or less, it is more preferably easy to form membranes. The conductive particle added in order to give conductivity is the transparency oxide which uses the tin oxide with a primary particle size of 0.1 micrometers or less or ITO as a principal component, and if distribution is enough, since thickness is thin, most attenuation of the light by absorption of a coat film cannot be found.

[0009] A polymerization nature monomer or an oligomer solution is applied, and if it is made to harden further by the method of heating, UV irradiation, electron beam irradiation, and one of ozone exposure and a bridge is made to construct in three dimensions, film reinforcement sufficient also with a thin film and adhesion reinforcement will be obtained. As a concrete material, a thermosetting polysiloxane or photoresist acrylic resin is mentioned. The solvent which melts a polymerization nature monomer or oligomer is an alcoholic system solvent, and does not commit the resin of glass or the film material generally used. If a bridge is made to construct in three dimensions in a raw material phase, since it will be hard coming to dissolve, it must be made to have to react after spreading and must be made to harden.

[0010]

[Example]

(Example 1) Gamma-glycidoxypropyltrimetoxysilane was dissolved in methyl cellosolve, the hydrochloric acid of the amount of catalysts was added, and it hydrolyzed by stirring at a room temperature. The dispersion liquid of a tin-oxide particle with a mean particle diameter of 80A were mixed there, and the amount addition of catalysts of the magnesium perchlorate was carried out further, and it fully stirred and considered as spreading liquid. It was a homogeneous sol, even if it carried out the mothball of the spreading liquid, it was stable, and precipitation was not seen.

[0011] Applied this spreading liquid to the transparent electrode side of a PET film with ITO, and the transparent electrode side of a glass plate with the tin oxide by the roll coat method, it was made to dry at 70 degrees C, and the siloxane macromolecule layer containing the tin-oxide particle of 0.1 micrometers of thickness was formed. Thickness is controllable in about 0.005 micrometers enough. The thin film formed of microscope observation checked that it was very precise and homogeneous. With the naked eye, existence of a tin-oxide particle was not accepted. The spectral characteristic of the permeability before and behind the macromolecule stratification which contained the conductive particle of a glass plate with the tin oxide in drawing 1 is shown. It turns out that permeability is improved 10% or more in the wavelength which is 550nm. Moreover, at 0.5% or less, the degree of overcast also had a high feeling of transparence.

[0012] Thus, the typical cross section of the touch panel using the produced transparence substrate is shown in drawing 2 . As for 21, for a glass substrate and 22, in drawing 2 , a PET substrate, and 23 and 24 are [a transparent electrode and 25] spacers. Moreover, 26 is a siloxane macromolecule layer containing the tin-oxide particle formed by the above-mentioned method. This decrease reflecting layer has electric

conductivity, and location detection was able to be carried out satisfactory at all as a touch panel of a resistance detection method.

[0013] It was not able to be observed at all, but the yield was good, and cost did not almost become comparatively high-priced, either, but, as for the unevenness in an input screen, has attained the legible touch panel with a feeling of transparence. The dazzle by surface reflection was not sensed almost. Moreover, reliability, such as heat, humidity, and light-proof, was also enough.

[0014] (Example 2) Pulled up at a suitable speed, and heat for 30 minutes, it was made to carry out pattern NINGU of the ITO electrode to both sides of a glass substrate, to dip this touch panel completely into the same spreading liquid as an example 1, and to harden at 150 degrees C, and the siloxane macromolecule layer containing the tin-oxide particle of 0.3 micrometers of thickness was formed. Thickness is controllable in about 0.01 micrometers enough. The thin film formed of microscope observation and optical evaluation checked that it was very precise and homogeneous. With the naked eye, existence of a tin-oxide particle was not accepted. The adhesion of this decrease reflective film is as good as cross cut adhesion tests 100/100, and abrasion-proof nature is steel wool of #0000 1kg/cm2 A blemish was not accepted even if it carried out 10 ****s, applying a load. Moreover, abnormalities were not accepted in the dropping experiment of alcohol, an acid, alkali, and a detergent.

[0015] Thus, the typical cross section of the touch panel of a capacitive sensing method using the produced glass substrate is shown in drawing 3 . In drawing 3 , 21 is a decrease reflecting layer which consists of a siloxane macromolecule layer in which a glass substrate and 23 contained the ITO electrode in, and 26 contained the tin-oxide particle. As a touch panel of a capacitive sensing method, location detection was able to be carried out satisfactory at all. Moreover, with the pencil of 2H, a blemish was not able to be given to the surface. The degree of hardness which does not have a use top problem in a nib to the exclusive pen which used Dirline was obtained. When LCD and the touch panel which have a back light were combined, the brightness in the display surface improved from conventional 50 candelas to 60 candelas. Most luminance distribution within a field was not observed, but the bright good-looking panel has been attained.

[0016] The reliability trial was performed to this touch panel. Separating in the high-humidity/temperature trial of 1000 hours in 50 degrees C and 90%RH, it did not generate and the crack etc. did not generate YAKE, either. Moreover, abnormalities were not accepted in the spalling test (-20 degrees C, 25 degrees C, and 60 degrees C). Abnormalities were not accepted in the daylight exposure test of 20000 Langley.

[0017] (Example 3) 3-meta-acryloxyprophyltrimethoxysilane was dissolved in ethylcellosolve, the hydrochloric acid of the amount of catalysts was added, and it hydrolyzed by stirring at a room temperature. The dispersion liquid of an ITO particle with a mean particle diameter of 200A were mixed there, and the amount addition of catalysts of the benzophenone was carried out further, and it fully stirred and considered as spreading liquid. Spreading liquid was a homogeneous sol, when saving it in the cool place, it was stable, and precipitation was not seen.

[0018] In the yellow room, this spreading liquid was applied to the transparent electrode side of a PET film with ITO, and the transparent electrode side of a glass plate with the tin oxide by the roll coat method, and membranes were formed. After heating at 50 degrees C for 3 hours, 1J irradiated ultraviolet rays and it considered as the acrylic siloxane macromolecule layer containing the hard high ITO particle of adhesion of 0.08 micrometers of thickness. Thickness is controllable in about 0.005 micrometers enough. The thin film formed of microscope observation checked that it was very precise and homogeneous. With the naked eye, existence of an ITO particle was not accepted. The adhesion of this decrease reflective film is as good as cross cut adhesion tests 100/100, and abrasion-proof nature is steel wool of #0000 1kg/cm2 A blemish was not accepted even if it carried out 10 ****s, applying a load. Moreover, abnormalities were not accepted in the dropping experiment of alcohol, an acid, alkali, and a detergent.

[0019] When the touch panel of a resistance detection method with the same structure as an example 1 was assembled, it has been improved 10% or more and the whole-line permeability as a touch panel became 89%. Moreover, at 1% or less, the degree of overcast also had a high feeling of transparence. when LCD and the touch panel of a reflective mold were combined, the brightness in the display surface was markedly

alike, and has been improved, and the legible good-looking panel has been attained. The reliability trial was performed to this touch panel with LCD. Separating in the high-humidity/temperature trial of 1000 hours in 50 degrees C and 90%RH, it did not generate and the crack etc. did not generate YAKE, either. Moreover, abnormalities were not accepted in the spalling test (-20 degrees C, 25 degrees C, and 60 degrees C). Abnormalities were not accepted in the daylight exposure test of 20000 Langley.

[0020] (Example 4) Acrylic oligomer was dissolved in the alcoholic system solvent, the dispersion liquid of an ITO particle with a mean particle diameter of 400A were mixed, and it fully stirred, and considered as spreading liquid. Spreading liquid was a homogeneous sol, when saving it in the cool place, it was stable, and precipitation was not seen.

[0021] In the yellow room, this spreading liquid was applied to the transparent electrode side of a PET film with ITO, and the transparent electrode side of a glass plate with the tin oxide by the roll coat method, and membranes were formed. After heating at 50 degrees C for 2 hours, with the acceleration voltage of 200 kilovolts, an electron ray is irradiated, and was stiffened, and it considered as the acrylic macromolecule layer containing the hard high ITO particle of adhesion of 0.1 micrometers of thickness. Thickness is controllable in about 0.005 micrometers enough. The thin film formed of microscope observation checked that it was very precise and homogeneous. With the naked eye, existence of an ITO particle was not accepted. The adhesion of this decrease reflective film is as good as cross cut adhesion tests 100/100, and abrasion-proof nature is steel wool of #0000 1kg/cm2 A blemish was not accepted even if it carried out 10 ****s, applying a load. Moreover, abnormalities were not accepted in the dropping experiment of alcohol, an acid, alkali, and a detergent.

[0022] When the touch panel of a resistance detection method with the same structure as an example 1 was assembled and the anti-glare film was stuck on the PET film surface, the whole-line permeability as a touch panel has been improved, and it became 85%. Moreover, there is reflected [no / outdoor daylight] and the legible good-looking panel has been attained. Moreover, reliability, such as heat, humidity, light-proof, and **-proof, was also enough.

[0023] (Example 5) The alcoholic solution "transparence antistatic coating liquid P104" (Chichibu Cement Co., Ltd. make) which the 100A antimony content tin-oxide ultrafine particle is distributing from the mean particle diameter of 50A and which a siloxane system low-molecular dissolved was applied to both sides of a glass plate with the tin oxide by dipping. Membranes are formed by part for 20cm/in raising speed, and you heated for 30 minutes and made it established at 80 degrees C. Since it was 0.06 micrometers, thickness forms membranes in piles by part for 20cm/in raising speed further, at 160 degrees C, was heated for 30 minutes and stiffened. Thickness was set to 0.12 micrometers and the outstanding decrease reflection effect was shown. The adhesion with the glass substrate of the siloxane macromolecule layer containing this tin-oxide particle is as good as cross cut adhesion tests 100/100, and abrasion-proof nature is steel wool of #0000 1kg/cm2 A blemish was not accepted even if it carried out 10 ****s, applying a load. Moreover, abnormalities were not accepted in the dropping experiment of alcohol, an acid, alkali, and a detergent.

[0024] The whole-line permeability of the obtained glass substrate has improved 93% from 88%. Moreover, the degree of overcast was also 0.2% and its feeling of transparence was high. When the touch panel of a resistance detection method with the same structure as an example 1 was assembled using the PET film which gave the transparent electrode of ITO to one side and gave the anti-dazzle coat to the rear face, it has been improved 5% or more and the whole-line permeability as a touch panel became 85%. Moreover, at 1% or less, the degree of overcast also had a high feeling of transparence. when LCD and the touch panel of a reflective mold were combined, the brightness in the display surface was markedly alike, and has been improved, and the legible good-looking panel has been attained. The reliability trial was performed to this touch panel with LCD. Separating in the high-humidity/temperature trial of 1000 hours in 50 degrees C and 90%RH, it did not generate and the crack etc. did not generate YAKE, either. Moreover, abnormalities were not accepted in the spalling test (-20 degrees C, 25 degrees C, and 60 degrees C). Abnormalities were not accepted in the daylight exposure test of 20000 Langley.

[0025] (Example 1 of a comparison) "Transparence antistatic coating liquid P104" (Chichibu Cement Co.,

Ltd. make) was applied to both sides of a glass plate with the tin oxide by dipping like the example 5. Membranes are formed by part for 10cm/in raising speed, and it heated for 30 minutes and was made to harden at 160 degrees C. Thickness was 0.04 micrometers, and although the decrease reflection effect was slightly shown in the short wavelength side, the whole-line permeability of this glass substrate was changeless with 88%. In observation by the naked eye, the improvement in clear visibility was not accepted with the degree from which the tint changed slightly.

[0026] (Example 2 of a comparison) After forming in both sides the siloxane macromolecule layer which contained the tin-oxide particle of 0.3 micrometers of thickness in the glass substrate with an ITO electrode by the same method as an example 2, membrane formation was made into the thickness of 0.6 micrometers of repeats once again. The whole-line permeability of this glass substrate fell slightly, and the interference fringe which the peculiar color attached was observed.

[0027] (Example 3 of a comparison) Gamma-glycidoxypropyltrimetoxysilane was dissolved in methyl cellosolve, the hydrochloric acid of the amount of catalysts was added, and it hydrolyzed by stirring at a room temperature. The dispersion liquid of an ITO particle with a mean particle diameter of 0.12 micrometers were mixed there, and the amount addition of catalysts of the magnesium perchlorate was carried out further, and it fully stirred and considered as spreading liquid. Although spreading liquid was a homogeneous sol after stirring, 1 hour after, precipitation was seen.

[0028] Applied the spreading liquid immediately after this stirring to the transparent electrode side of a glass plate with ITO by the roll coat method, it was made to dry at 120 degrees C, and the siloxane macromolecule layer containing the ITO particle of 0.12 micrometers of average thickness was formed. The whole-line permeability of this glass substrate fell to 80% from 88%, and its degree of overcast was also as high as 10%.

[0029]

[Effect of the Invention] As stated above, according to this invention, formation being possible and the touch panel excellent in highly transparent and good-looking manufacture stability were able to be easily offered by offering the transparent electrode which carried out the laminating of the macromolecule layer containing a conductive particle with the outstanding decrease reflection effect. They were detection precision and the thing which suits practical use also in reliability. Since a bill-of-materials top is not different from the former at all, the touch panel of this invention can acquire a big effect immediately by installation of this invention.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is spectrum drawing showing the spectral characteristic of a reflection factor of the glass plate with the tin oxide in this invention.
[Drawing 2] It is the cross section which expresses typically the concept of the touch panel in the example 1 of this invention.
[Drawing 3] It is the cross section which expresses typically the concept of the touch panel in the example 2 of this invention.
[Description of Notations]
11 ..... Spectral characteristic curve of a glass plate with the tin oxide
12 ..... Spectral characteristic curve of the glass plate with the tin oxide in which the macromolecule layer containing a conductive particle was formed
21 ..... Glass substrate
22 ..... PET substrate
23 ..... Tin-oxide electrode
24 ..... ITO electrode
25 ..... Spacer
26 ..... Macromolecule layer containing a conductive particle

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[Translation done.]

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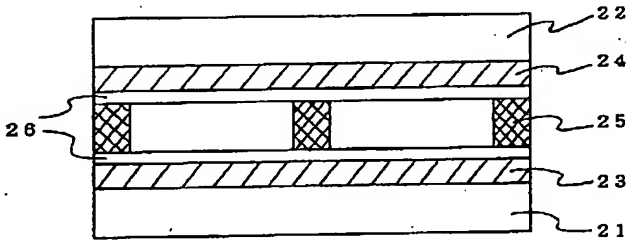
(54)【発明の名称】　タッチパネル及びその製造法

(57)【要約】

【目的】　透明度が高くて見栄えの良い、製造安定性に優れたタッチパネルを提供する。

【構成】　本発明のタッチパネルは、透明基板の透明電極表面上に、導電性微粒子を含んだ高分子層が形成されていることを特徴とする。導電性微粒子は、一次粒径０．１μｍ以下の酸化スズまたはＩＴＯを主成分とする透明性酸化物であり、高分子は熱硬化性ポリシロキサンまたは光硬化性アクリル樹脂である。膜厚は０．０５μｍから０．３μｍが好ましい。また、前記タッチパネルにおいて、透明電極表面の少なくとも一面に、導電性微粒子が分散した重合性モノマーまたはオリゴマー溶液を塗布し、更に加熱、紫外線照射、電子線照射、オゾン曝露いずれかの方法で硬化させ、導電性微粒子を含んだ高分子層を形成することにより製造できる。それにより、優れた減反射効果が得られ透明度が向上する。



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【特許請求の範囲】

【請求項１】　一枚以上の透明電極を有する透明基板から構成されるタッチパネルにおいて、透明電極表面の少なくとも一面に導電性微粒子を含んだ高分子層が形成されていることを特徴とするタッチパネル。

【請求項２】　前記高分子が、熱硬化性ポリシロキサンまたは光硬化性アクリル樹脂であることを特徴とする請求項１記載のタッチパネル。

【請求項３】　前記導電性微粒子が、一次粒径０．１μｍ以下の酸化スズまたはＩＴＯを主成分とする透明性酸化物であることを特徴とする請求項１記載のタッチパネル。

【請求項４】　前記導電性微粒子を含んだ高分子層が、０．０５μｍ以上０．３５μｍ以下の平均膜厚であることを特徴とする請求項１記載のタッチパネル。

【請求項５】　一枚以上の透明電極を有する透明基板から構成されるタッチパネルにおいて、透明電極表面の少なくとも一面に、導電性微粒子が分散した重合性モノマーまたはオリゴマー溶液を塗布し、更に加熱、紫外線照射、電子線照射、オゾン曝露いずれかの方法で硬化させ、導電性微粒子を含んだ高分子層を形成することを特徴とするタッチパネルの製造法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、透明度が高くて見栄えの良い、製造安定性に優れたタッチパネルに関する。

【０００２】

【従来の技術】入力装置に用いられるタッチパネルは、抵抗検出方式、静電容量方式、電磁誘導方式等検出方式に違いがあるものの、一枚以上の透明電極を有する透明基板から構成される構造が一般的である。透明基板としてはガラス板かＰＥＴ（ポリエチレンテレフタレート）が通常用いられており、透明電極としてはＩＴＯや酸化スズが用いられている。透明電極は全面均一の場合もあるし、パターンニングして用いる場合もある。ペン入力面は書き味改善や防眩のため、プラスチックフィルムを張り付けたり、表面に微細な凹凸面を設けた構造を取るようになった。タッチパネルは単体の入力装置としてだけでなく、ＣＲＴやＬＣＤと組み合せ、表示画面上で情報操作できる装置としても利用されている。

【０００３】

【発明が解決しようとする課題】しかし、タッチパネルは一枚以上の透明電極を有する透明基板から構成されているため、透明基板内での光量の減衰がほとんどないものの、特に透明電極と空気界面による表面反射により、１０％以上の光量が失われてしまうという課題があった。また、表面反射によりパネルが見づらく、特に表示素子と併用して用いる場合には大きな問題であった。防眩のため、アンチグレアフィルムを張り付けたり、表面に微細な凹凸面を設けた構造を取ると、更に光の全透過

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量の１０％から２０％の光量が失われてしまい、表面の乱反射により白ボケして表示画質が低下するという課題があった。

【０００４】減反射コーティングとしては、フッ化マグネシウム等の低屈折率材料を蒸着する方法や、屈折率の異なる材料を多層蒸着する方法が知られ、眼鏡レンズなどで実用化されている。また、屈折率の低い含フッ素高分子を塗布により形成する方法も提示されている。しかし、従来の減反射コーティング材料は絶縁性が高く、特に最も一般的な抵抗検出方式では、電極上に形成されると位置検出できないという致命的な欠陥があった。また密着性や表面硬度にも問題があった。

【０００５】そこで本発明はこのような課題を解決するもので、その目的とするところは、透明度が高くて見栄えの良い、製造安定性に優れたタッチパネルを提供するところにある。

【０００６】

【課題を解決するための手段】上記目的は、一枚以上の透明電極を有する透明基板から構成されるタッチパネルにおいて、透明電極表面の少なくとも一面に導電性微粒子を含んだ高分子層が形成されていることで達成される。また、前記タッチパネルにおいて、透明電極表面の少なくとも一面に、導電性微粒子が分散した重合性モノマーまたはオリゴマー溶液を塗布し、更に加熱、紫外線照射、電子線照射、オゾン曝露いずれかの方法で硬化させ、導電性微粒子を含んだ高分子層を形成することにより製造できる。

【０００７】

【作用】光の反射強度は屈折率差が大きい界面ほど大きくなる。透明電極として通常用いられる酸化スズやＩＴＯは、屈折率が１．６から１．７と高く、透明電極と空気との界面での反射が最も大きい。減反射コーティングとして用いるには、コーティング材の屈折率が、基材の屈折率の平方根となるのが理想的である。計算上は屈折率１．３０以下が理想であるが、透明電極の屈折率が高いため、コーティング材の屈折率１．５５以下であればある程度の効果が得られる。

【０００８】普通に反射防止効果を得るために用いられる膜厚は、（光の波長）÷４÷（膜の屈折率）の奇数倍で求められ、実用的には０．０５μｍ以上０．３５μｍ以下の平均膜厚であり、より好ましくは０．０７μｍ以上０．１２μｍ以下であるため成膜が容易である。導電性を付与するために添加する導電性微粒子が、一次粒径０．１μｍ以下の酸化スズまたはＩＴＯを主成分とする透明性酸化物であり、分散が十分であれば、膜厚が薄いためコート膜の吸収による光の減衰もほとんど無い。

【０００９】重合性モノマーまたはオリゴマー溶液を塗布し、更に加熱、紫外線照射、電子線照射、オゾン曝露いずれかの方法で硬化させ三次元的に架橋させると、薄膜でも十分な膜強度と密着強度が得られる。具体的な材

料としては熱硬化性ポリシロキサンまたは光硬化性アクリル樹脂が挙げられる。重合性モノマーまたはオリゴマーを溶かす溶剤は、アルコール系溶媒であり、ガラスや一般的に用いられるフィルム材料の樹脂を犯すことはない。原料段階で三次元的に架橋させてしまうと、溶解しにくくなるため、塗布後に反応させ硬化させなければならない。

【００１０】

【実施例】

（実施例１）メチルセロソルブにγ－グリシドキシプロピルトリメトキシシランを溶解し触媒量の塩酸を加え、室温で撹拌して加水分解を行なった。そこに平均粒径８０Åの酸化スズ微粒子の分散液を混合し、更に過塩素酸マグネシウムを触媒量添加し、十分に撹拌し塗布液とした。塗布液は均質なゾルであり長期保存しても安定で、沈澱はみられなかった。

【００１１】この塗布液をＩＴＯ付きＰＥＴフィルムの透明電極面、及び酸化スズ付きガラス板の透明電極面にロールコート法で塗布し、７０℃で乾燥させ、膜厚０．１μmの酸化スズ微粒子を含んだシロキサン高分子層を形成した。膜厚は０．００５μm程度の範囲で十分制御できる。顕微鏡観察により形成された薄膜は、非常に緻密かつ均質であることを確認した。酸化スズ微粒子の存在は、肉眼では認められなかった。図１に酸化スズ付きガラス板の、導電性微粒子を含んだ高分子層形成前後の透過率の分光特性を示す。透過率が５５０nmの波長において、１０％以上改善されていることがわかる。また曇度も０．５％以下で、透明感が高かった。

【００１２】このようにして作製した透明基板を用いたタッチパネルの、模式的な断面図を図２に示す。図２において、２１はガラス基板、２２がＰＥＴ基板、２３と２４が透明電極、２５がスペーサーである。また、２６が前述の方法で形成した酸化スズ微粒子を含んだシロキサン高分子層である。この減反射層は電気導電性を有しており、抵抗検出方式のタッチパネルとして、全く問題なく位置検出することができた。

【００１３】入力面内のむらは全く観察されず、透明感のある見やすいタッチパネルを歩留まり良く、コストもほとんど割高にならず達成できた。表面反射による眩しさはほとんど感じなかった。また、熱、湿度、耐光等の信頼性も十分であった。

【００１４】（実施例２）ガラス基板の両面にＩＴＯ電極をパターンニングし、実施例１と同様の塗布液中にこのタッチパネルを完全に浸し、適当な速度で引き上げ１５０℃で３０分間加熱して硬化させ、膜厚０．３μmの酸化スズ微粒子を含んだシロキサン高分子層を形成した。膜厚は０．０１μm程度の範囲で十分制御できる。顕微鏡観察および光学的評価により形成された薄膜は、非常に緻密かつ均質であることを確認した。酸化スズ微粒子の存在は、肉眼では認められなかった。この減反射

膜の密着性は、碁盤目試験１００／１００と良好で、耐擦傷性は＃００００のスチールウールを１kg／cm^{2}の荷重をかけて１０往復させても傷が認められなかった。また、アルコール、酸、アルカリ、洗剤の滴下実験において異常は認められなかった。

【００１５】このようにして作製したガラス基板を用いた静電容量方式のタッチパネルの、模式的な断面図を図３に示す。図３において、２１はガラス基板、２３がＩＴＯ電極、２６が酸化スズ微粒子を含んだシロキサン高分子層からなる減反射層である。静電容量方式のタッチパネルとして、全く問題なく位置検出することができた。また２Ｈの鉛筆では、表面に傷をつけることができなかった。ペン先にデルリンを用いた専用ペンに対して、使用上問題の無い硬度が得られた。バックライトを有するＬＣＤとタッチパネルを組み合せたところ、表示表面における輝度は、従来の５０カンデラから６０カンデラに向上した。面内の輝度分布もほとんど観察されず、明るく見栄えの良いパネルを達成できた。

【００１６】このタッチパネルに対し、信頼性試験をおこなった。５０℃、９０％ＲＨで１０００時間の高温高湿試験において、剥がれ、クラック等は発生せず、ヤケも発生しなかった。また－２０℃、２５℃、６０℃の熱衝撃試験においても、異常は認められなかった。２００００ラングレイの日光暴露試験においても、異常は認められなかった。

【００１７】（実施例３）エチルセロソルブに３－メタアクリロキシプロピルトリメトキシシランを溶解し触媒量の塩酸を加え、室温で撹拌して加水分解を行なった。そこに平均粒径２００ÅのＩＴＯ微粒子の分散液を混合し、更にベンゾフェノンを触媒量添加し、十分に撹拌し塗布液とした。塗布液は均質なゾルであり冷暗所で保存すれば安定で、沈澱はみられなかった。

【００１８】イエロールーム内で、この塗布液をＩＴＯ付きＰＥＴフィルムの透明電極面、及び酸化スズ付きガラス板の透明電極面に、ロールコート法で塗布し成膜した。５０℃で３時間加熱した後、紫外線を１ジュール照射し、膜厚０．０８μmの硬く密着性の高いＩＴＯ微粒子を含んだアクリルシロキサン高分子層とした。膜厚は０．００５μm程度の範囲で十分制御できる。顕微鏡観察により形成された薄膜は、非常に緻密かつ均質であることを確認した。ＩＴＯ微粒子の存在は、肉眼では認められなかった。この減反射膜の密着性は、碁盤目試験１００／１００と良好で、耐擦傷性は＃００００のスチールウールを１kg／cm^{2}の荷重をかけて１０往復させても傷が認められなかった。また、アルコール、酸、アルカリ、洗剤の滴下実験において異常は認められなかった。

【００１９】実施例１と同様の構造をもつ抵抗検出方式のタッチパネルを組み立てたところ、タッチパネルとしての全線透過率が、１０％以上改善されて８９％となっ

た。また曇度も１％以下で、透明感が高かった。反射型のＬＣＤとタッチパネルを組み合せたところ、表示表面における明るさが格段に改善され、見やすく見栄えの良いパネルを達成できた。このＬＣＤ付タッチパネルに対し、信頼性試験をおこなった。５０℃、９０％ＲＨで１０００時間の高温高湿試験において、剥がれ、クラック等は発生せず、ヤケも発生しなかった。また－２０℃、２５℃、６０℃の熱衝撃試験においても、異常は認められなかった。２０００ラングレイの日光暴露試験においても、異常は認められなかった。

【００２０】（実施例４）アルコール系溶媒にアクリル系のオリゴマーを溶解し、平均粒径４００ÅのＩＴＯ微粒子の分散液を混合し、十分に撹拌し塗布液とした。塗布液は均質なゾルであり冷暗所で保存すれば安定で、沈澱はみられなかった。

【００２１】イエロールーム内で、この塗布液をＩＴＯ付きＰＥＴフィルムの透明電極面、及び酸化スズ付きガラス板の透明電極面に、ロールコート法で塗布し成膜した。５０℃で２時間加熱した後、電子線を２００キロボルトの加速電圧で照射して硬化させ、膜厚０．１μｍの硬く密着性の高いＩＴＯ微粒子を含んだアクリル高分子層とした。膜厚は０．００５μｍ程度の範囲で十分制御できる。顕微鏡観察により形成された薄膜は、非常に緻密かつ均質であることを確認した。ＩＴＯ微粒子の存在は、肉眼では認められなかった。この減反射膜の密着性は、碁盤目試験１００／１００と良好で、耐擦傷性は＃０００００のスチールウールを１ｋｇ／ｃｍ^2 の荷重をかけて１０往復させても傷が認められなかった。また、アルコール、酸、アルカリ、洗剤の滴下実験において異常は認められなかった。

【００２２】実施例１と同様の構造をもつ抵抗検出方式のタッチパネルを組み立て、ＰＥＴフィルム表面に防眩フィルムを貼りつけたところ、タッチパネルとしての全線透過率が改善されて８５％となった。また外光の映り込みがなく、見やすく見栄えの良いパネルを達成できた。また、熱、湿度、耐光、耐擦等の信頼性も十分であった。

【００２３】（実施例５）平均粒径５０Åから１００Åのアンチモン含有酸化スズ超微粒子が分散している、シロキサン系低分子が溶解したアルコール溶液「透明帯電防止コーティング液Ｐ１０４」（秩父セメント社製）を、酸化スズ付きガラス板の両面にディッピングにより塗布した。引き上げ速度２０ｃｍ／分で成膜し、８０℃で３０分間加熱して定着させた。膜厚は０．０６μｍであったので、更に引き上げ速度２０ｃｍ／分で重ねて成膜し、１６０℃で３０分間加熱して硬化させた。膜厚は０．１２μｍとなり、優れた減反射効果を示した。この酸化スズ微粒子を含んだシロキサン高分子層のガラス基板との密着性は、碁盤目試験１００／１００と良好で、耐擦傷性は＃０００００のスチールウールを１ｋｇ／ｃｍ^2 の荷重をかけて１０往復させても傷が認められなかった。また、アルコール、酸、アルカリ、洗剤の滴下実験において異常は認められなかった。

【００２４】得られたガラス基板の全線透過率は、８８％から９３％改善された。また曇度も０．２％であり、透明感が高かった。ＩＴＯの透明電極を片面に、裏面に防眩コートを施したＰＥＴフィルムを用いて、実施例１と同様の構造をもつ抵抗検出方式のタッチパネルを組み立てたところ、タッチパネルとしての全線透過率が、５％以上改善されて８５％となった。また曇度も１％以下で、透明感が高かった。反射型のＬＣＤとタッチパネルを組み合せたところ、表示表面における明るさが格段に改善され、見やすく見栄えの良いパネルを達成できた。このＬＣＤ付タッチパネルに対し、信頼性試験をおこなった。５０℃、９０％ＲＨで１０００時間の高温高湿試験において、剥がれ、クラック等は発生せず、ヤケも発生しなかった。また－２０℃、２５℃、６０℃の熱衝撃試験においても、異常は認められなかった。２０００ラングレイの日光暴露試験においても、異常は認められなかった。

【００２５】（比較例１）実施例５と同様に「透明帯電防止コーティング液Ｐ１０４」（秩父セメント社製）を、酸化スズ付きガラス板の両面にディッピングにより塗布した。引き上げ速度１０ｃｍ／分で成膜し、１６０℃で３０分間加熱して硬化させた。膜厚は０．０４μｍであり、短波長側ではわずかに減反射効果を示したものの、このガラス基板の全線透過率は、８８％のままで変化がなかった。肉眼による観察においても、わずかに色味が変化した程度で、明らかな視認性の向上は認められなかった。

【００２６】（比較例２）実施例２と同様な方法で両面にＩＴＯ電極が付いたガラス基板に、膜厚０．３μｍの酸化スズ微粒子を含んだシロキサン高分子層を形成した後、もう一度成膜を繰り返し０．６μｍの膜厚とした。このガラス基板の全線透過率は僅かに低下し、独特の色がついた干渉縞が観察された。

【００２７】（比較例３）メチルセロソルブにγ－グリシドキシプロピルトリメトキシシランを溶解し触媒量の塩酸を加え、室温で撹拌して加水分解を行なった。そこに平均粒径０．１２μｍのＩＴＯ微粒子の分散液を混合し、更に過塩素酸マグネシウムを触媒量添加し、十分に撹拌し塗布液とした。塗布液は撹拌後は均質なゾルであったが、１時間後には沈澱がみられた。

【００２８】この撹拌直後の塗布液をＩＴＯ付きガラス板の透明電極面にロールコート法で塗布し、１２０℃で乾燥させ、平均膜厚０．１２μｍのＩＴＯ微粒子を含んだシロキサン高分子層を形成した。このガラス基板の全線透過率は、８８％から８０％に低下し、曇度も１０％と高かった。

【００２９】

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【発明の効果】以上述べたように、本発明によれば容易に形成可能かつ、優れた減反射効果のある導電性微粒子を含んだ高分子層を積層した透明電極を提供することによって、透明度が高くて見栄えの良い、製造安定性に優れたタッチパネルを提供することができた。検出精度や、信頼性においても実用にかなうものであった。本発明のタッチパネルは部品構成上は全く従来と変わらないため、本発明の導入により即座に大きな効果を得ることができる。

【図面の簡単な説明】

【図１】　本発明における酸化スズ付きガラス板の、反射率の分光特性を示すスペクトル図である。

【図２】　本発明の実施例１におけるタッチパネルの概念を模式的に表す断面図である。

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【図３】　本発明の実施例２におけるタッチパネルの概念を模式的に表す断面図である。

【符号の説明】

１１……酸化スズ付きガラス板の分光特性曲線

１２……導電性微粒子を含んだ高分子層を形成した酸化スズ付きガラス板の分光特性曲線

２１……ガラス基板

２２……ＰＥＴ基板

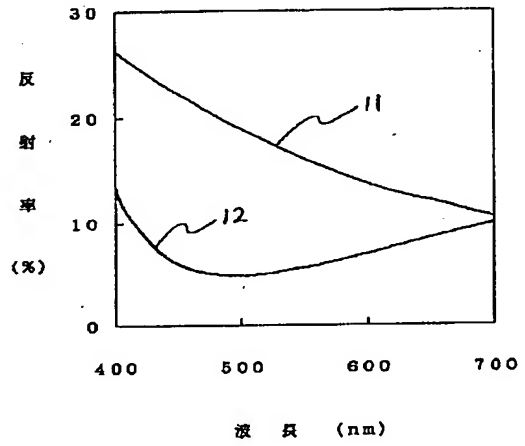
２３……酸化スズ電極

２４……ＩＴＯ電極

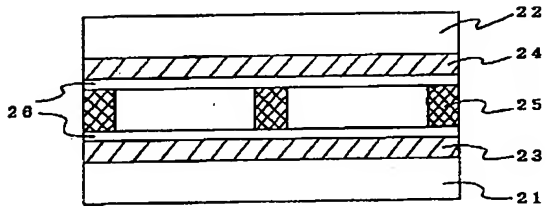
２５……スペーサー

２６……導電性微粒子を含んだ高分子層

【図１】



【図２】



【図３】